

# OPERATING EXPERIENCE SUMMARY



## Office of Nuclear and Facility Safety

December 16, 1999 – January 14, 1999

Summary 2000-01

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## 1. MECHANIC INJURED IN FALL FROM INCOMPLETE SCAFFOLD

On December 21, 1999, at the Savannah River Site, a Separations Mechanic fell while descending a 9-foot scaffold. Site Emergency Medical Services personnel responded by providing first aid, and transported the mechanic to the Aiken Regional Medical Center Hospital. The mechanic suffered a fractured right ankle, which required surgery to insert a plate and eight screws. The scaffolding carried an incomplete assembly tag because obstructions prevented the installation of a grab rail or a ladder that extended above the working platform. Failure to properly assemble and use equipment can cause severe injury. (ORPS Report SR--WSRC-SEPGEN-1999-0004)

Investigators determined that the mechanic had finished his assistance to a welder and lost his footing approximately 5 to 6 feet above the floor while descending the scaffold. Investigators determined that he lay on his stomach and placed his legs over the edge of the platform to contact the first rung of the scaffold ladder to begin his descent. The mechanic disconnected his safety harness before descending, because the lanyard was shorter than the distance to the floor, and he was not permitted to perform this task while on the ladder. He then fractured his right ankle in two places, lost one workday, and is being treated with prescription medication, a cast, and crutches.

Investigators found that the mechanic fell from a scaffold that was incomplete because of an obstruction, but declared acceptable for use. Investigation determined that the safety manual allows for incomplete scaffold installation when obstructions exist to be acceptable if the reason for incompleteness is properly labeled. If the incomplete tag is due to an unacceptability or deviation from requirements, the scaffold is to be labeled, "danger, do not use." The investigators determined that this scaffold did not have required handrails or appropriate ladder and should not have been used.

A critique of the event was held and included a recommendation that all scaffolding around the site be inspected. The site survey determined that the Savannah River Site uses principally two types of scaffolding: tubular welded frame and tube and coupler. The primary deficiency, found during the inspections was the mixing of different scaffolding manufacturers' materials in an assembly.

Corrective actions identified include clarifying the site safety manual requirements concerning mixing incompatible scaffold materials and scaffold completeness. Scaffold training will also be evaluated to ensure consistency with requirement for operation and construction of scaffolds, and to emphasize the need for compliance.

EH reported on a similar event in 1995.

- OE Summary 95-15 reported that, on April 4, 1995, an operator at the Savannah River Site, In Tank Precipitation (ITP) Facility fell from a ladder while constructing a radiological contamination hut in a contamination area. The operator fractured his left wrist and lacerated his chin. The operator was transported to a local hospital where surgery was performed to repair his wrist and to stitch a laceration on his chin. (ORPS Report SR--WSRC-ITP-1995-0017)

At the critique for this event, the root cause was determined to be an inadequate work environment because there was no scaffolding or platform erected for this elevated work, and there were no handrails on the ladder. The sides of the ladder extended approximately six inches above the top rung and there was nothing an individual could grasp for support. Other ladders at the facility have sides or handrails that extend approximately three feet above the top rung. These handrails provide support which enable workers to maintain balance when stepping onto or off of a ladder.

Data from the Bureau of Labor Statistics (<http://stats.bls.gov/oshhome.htm>) indicates that every year, approximately 180 American workers lose their lives in falls from ladders and scaffolding. When all falls are considered, i.e., those from roofs and structures as well, the annual number of fatalities rises to approximately 650. Many of these accidents occurred from relatively low heights but involved fatal impacts of the head or spine.

Scaffold and ladder safety requirements can be found in OSHA Standards (29CFR1910.25, 1910.26, and 1920.27) (<http://www.osha.gov>). Additional information and recommendations can be found in the Department of Energy (DOE) OSH Technical Reference (OTR) ([http://tis.eh.doe.gov/docs/osh\\_tr/otr.html](http://tis.eh.doe.gov/docs/osh_tr/otr.html)). Lastly, EH Bulletin EH-93-05, *Ladders: Familiarity Breeds Complacency* (<http://tis.eh.doe.gov/docs/bull/links.html>) has perhaps the best guidance for ladders:

**"Taking a Good Look – The Critical Safety Measure.** Visual inspection of equipment and the work area prior to beginning the task is critical to using ladders safely. Ladders should be inspected for defects and to assure that they are tall enough for the job at hand. You should be able to reach what you are doing comfortably; ladders for roof work should project 3 feet above the eaves, gutter, or roofline."

**KEYWORDS:** fall protection, scaffolding, inspections

**FUNCTIONAL AREAS:** Worker Safety, Inspection

## 2. **CRITICALITY SAFETY LIMIT EXCEEDED IN CRITICALITY CONTROLLED AREA**

On December 7, 1999, at Pacific North National Laboratory, a Radiochemical Processing Laboratory Representative identified that a criticality safety mass limit may have been exceeded in a criticality safety controlled area. The criticality evaluation team immediately reviewed the site conditions and confirmed that though the sum-of-fractions critical mass limit of 1.022 was over the 1.00 limit, the double contingency principle and criticality safety were not compromised. A prompt criticality review at the facility ensured that there was no likelihood of a criticality event. (ORPS Report RL--PNNL-PNNLNUCL-1999-0018)

The Radiochemical Processing Laboratory Criticality Safety Representative stopped the work and locked the Criticality Safety Controlled Area to prevent personnel's inadvertent access to the area. The representative notified the Senior Criticality specialists, Radiochemical Processing Laboratory Criticality Safety Line Manager, Cognizant Line Manager, and the building Manager of the event. An event evaluation team began development of a recovery plan.

Investigators determined that fissile material movement to the Criticality Safety Controlled Area exceeded the Sum-of-Fractional Critical Mass limit of 1.00, as stated in the Criticality Safety Specifications. However, the Double Contingency Principles of Mass and Separation Distance between this stored material and the material stored in the adjoining Criticality Safety Exempt Area was not compromised. The Sum-of-Fractional-Critical Mass was only 1.022, while the Separation Distance was more than a mandatory minimum of 3.00 feet. This precluded criticality occurrence.

The investigation further determined that the Criticality Safety Manager for the Criticality Safety Controlled Area erred in using an out-of-date general-guidance criticality manual in computing Sum-of-fractional critical masses of the fissile materials. Instead, the applicable administrative criticality safety specifications incorporating additional safety margin for the area are to be used.

EH has reported on similar events.

- OE Summary 99-19 reported that on May 6, 1999, at the Rocky Flats Environmental Technology Site Plutonium Fabrication Pyrochemical Operations, a criticality safety officer declared two criticality infractions. Facility personnel packaged 275g of plutonium in a 55-gal drum, violating the 200g plutonium limit. Facility personnel then stored the 55-gal drum within 24 in. of a JH-98 drum, violating the spacing requirements for JH-98 drums. JH-98 drums are drums that contain more than 200g of plutonium. Criticality safety personnel posted the 55-gal drum as a criticality safety infraction and labeled it as a JH-98 drum. The facility manager suspended all non-waste drum-loading activities, initiated a recovery plan, and directed facility personnel to move the drum to a proper storage location. Failure to meet criticality safety operating limit requirements led to reduce criticality safety margins. (ORPS Report RFO--KHLL-PUFAB-1999-0027)

These events illustrate the importance of having rigorous criticality safety programs. Further, in each case, the criticality infraction was identified by a worker or inspector exhibiting a questioning attitude and prompt reporting. Worker vigilance to administrative controls is the backbone of a criticality safety program. Unfortunately, in each of these events, personnel failed to follow proper criticality safety specifications documents, area postings, and work was performed without a review of the appropriate criticality safety operating limits. Facility managers and line supervisors should ensure that pre-job briefings are held, the responsibilities of personnel are clearly defined, and task expectations are correctly understood. They should also monitor operations by performing frequent direct observations of specific activities and routine walk-downs.

Facility managers should ensure that all operators and supervisors are familiar with operating procedures and understand their purpose and use. This is even more important when criticality safety issues are involved. If the supervisors or operators suspect a low margin of safety, they should act with excessive conservatism to prevent any criticality situation. The following orders and standards provide guidance on the handling and storage of fissile materials as they pertain to nuclear criticality safety.

DOE O 420.1, *Nuclear Criticality Safety*, provides direction for establishing nuclear criticality safety program requirements.

DOE-STD-1071-94, *Guideline to Good Practices for Material Receipt, Inspection, Handling, Storage, Retrieval, and Issuance at DOE Nuclear Facilities*, section 3.4.2, discusses the precautions to be considered when moving materials and recommends that personnel who perform this work should be trained using a performance-based program.

ANSI/ANS-8.19-1984, *Administrative Practices for Nuclear Criticality Safety*, provides the criteria for administration of an effective nuclear criticality safety program for operations outside reactors in which there exists a potential for criticality accidents. Sections 4, 5, and 6 address responsibilities for managers, supervisors, and members of the nuclear criticality safety staff.

**KEYWORDS:** criticality safety, work control

**FUNCTIONAL AREAS:** Nuclear Criticality Safety, Operations

### 3. **WORKER'S HAND PUNCTURED WHEN COLONY PICKER ROBOT COLLAPSES**

On December 19, 1999, at the Lawrence Berkley Laboratory, a worker received punctures to the right hand when a damaged colony picker robot collapsed. The colony picker robot uses small needles to pick colonies of E. Coli cells for sampling. The worker did not believe she was injured seriously, and went home without reporting the event or seeking medical attention. Later, when she developed pain and swelling she admitted herself to the hospital where she received antibiotic treatment. She was released two days later after responding well to the medication. The worker was the only person present when the event occurred and facility management is scheduled to review the incident with her on January 7, 2000. Malfunctioning equipment can lead to serious injury. (ORPS Report OAK--LBL-EHS-1999-0005)

Investigators determined that the robot did not reset properly after a power outage occurred during the night and it did not return to a safe, inactive position. They determined that when the worker arrived at the laboratory she found the robot in the down position with several of its needles damaged from impact. Investigators determined that the worker lifted the robot to a position where she thought it would remain suspended while she inspected the damaged needles. They determined that as she bent the needles back in place the robot fell and two of its needles punctured the skin on her right hand. Investigators have not yet determined the exact nature of the computer control problem that occurred when power was lost. New findings will be reported in future OE Summaries

**KEYWORDS:** injury, puncture wound, robot, equipment failure

**FUNCTIONAL AREAS:** Industrial Safety, Mechanical Maintenance

#### 4. CERAMIC VESSEL SHATTERS DURING MICROWAVE DRYING PROCESS

On December 13, 1999, at the Savannah River Site, a vessel head containing fecal material, Diphonix resin and nitric acid ruptured inside an energized microwave oven while a chemist and a technician performed a drying procedure. When the chemist heard an explosion, he verified that the technician was not injured and turned off the oven. The chemist notified his manager and evacuated all personnel from the laboratory when he noticed a reddish-color gas suspended in the air near the oven and found vessel pieces on the floor. There were no vessel contents found on the floor and there were no injuries associated with this event. High temperatures and pressures associated with laboratory testing can cause serious injury and equipment damage. (ORPS Report SR--WSRC-LTA-1999-0039)

Investigators determined that a prior incident occurred on December 2, 1999, when the recently calibrated microwave oven caused a vessel rupture 20 minutes into a sample run. They determined the probable causes, implemented lessons learned and resumed operations. After the recurrence on December 13<sup>th</sup>, investigators conducted surveys of the inner surface of the oven and ruptured vessel with the knowledge that the fecal samples could contain low radioactivity levels. Facility management placed a warning tag on the oven and notified similar oven users of the event. Investigators determined that the rupture disk designed to relieve vessel pressure failed to function. They determined that the rupture disk failure contributed to the explosion and prescribed the following corrective actions to prevent future occurrences.

- Notify the DOE complex about lessons learned and the hazards associated with using microwave ovens
- Evaluate the need to include the drying procedure in the Site Pressure Protection Program
- Perform an evaluation of the vessel to determine failure mode

The investigation will continue and any new findings will be included in future OE Summary articles.

**KEYWORDS:** equipment failure, explosion, microwave oven, rupture disk, pressure relief

**FUNCTIONAL AREAS:** Industrial Safety, Mechanical Maintenance

#### 5. INCORRECT VALVES USED ON REFURBISHED RESPIRATORS

On December 15, 1999, at the Oak Ridge Site, an ORNL Respirator Test Facility Industrial Hygiene Manager reported that inspections of used full-face respirators determined that 3 of 123 had exhalation valves approved for use only on half-face respirators. The use of incorrect valves constitutes a National Institute for Occupational Safety and Health (NIOSH) violation for certified respirators. This noncompliance with NIOSH Approval Certification is a potential safety hazard for workers. (ORPS Report ORO--LMES-Y12SITE-1999-0061)



Investigation determined that Y-12 respirator inspection had been conducted by K-25 by a contract until December 1998. by K-25 for ETTP. They also determined that ORNL replaced ETTP as the contractor for refurbishing full-face respirators in January 1999. A Mis-configured respirator was discovered in the first batch of respirators returned to ORNL in December 1999 for reconditioning. Investigators further determined that this first shipment of used respirators had been cleaned and refurbished by K-25. ORNL inspected an additional 100 respirators and discovered 2 more with half-face exhalation valve housings installed on full-face respirators. There appeared to be no compromise of the respirator protection factor since some of these refurbished respirators were improperly configured and in violation of OSHA. Y-12 operations suspended use of re-conditioned respirators pending re-inspection and re-certification by the ORNL Respirator Test Facility. Y-12 will use only new respirators, or those re-certified by ORNL.

**KEYWORDS:** respirator, NIOSH, inspection

**FUNCTIONAL AREAS:** Quality Assurance, Testing, Respirator Safety

## **6. HIGH PRESSURE DAMAGES FIRE-RATED DOOR DURING DAMPER TEST**

On December 20, 1999, at the Savannah River Site, a ventilation system pressure spike warped a fire-rated door when maintenance personnel conducted a test of facility dampers. Maintenance personnel immediately reduced the negative pressure on the door and notified facility management who investigated the door's integrity, barricaded the area and established an hourly fire watch. There were no injuries associated with this event. High differential pressures can lead to personnel injury and equipment damage. (ORPS Report SR--WSRC-REACK-1999-0030)

Investigators determined that maintenance personnel were conducting their test when one of the dampers failed in the closed position causing a higher than normal differential pressure across the fire door. They determined that the 1/2-inch differential pressure permanently bowed the door 1/4-inch at its center, leaving a gap between the door and the door jamb. Investigators determined that the door no longer met design criteria and would have to be replaced. They also determined that a vacuum break should be installed to ensure that high differential pressures do not prevent personnel from operating fire-rated doors in emergencies.

**KEYWORDS:** equipment failure

**FUNCTIONAL AREAS:** Industrial Safety, Mechanical Maintenance

## **7. DOE AND LANL RECEIVE COMPLIANCE ORDERS FROM STATE OF NEW MEXICO**

EH engineers reviewed two New Mexico Environmental Department compliance orders that were issued for Los Alamos National Laboratory (LANL). On December 15, 1999, a compliance order was issued to the DOE and the Regents of the University of California concerning the annual Resource Conservation and Recovery Act annual inspection conducted in 1997. The 29 alleged violations proposed penalties totaling \$1,168,766. On January 3, 2000, a compliance order was also issued the DOE and the Regents of the

University of California from the New Mexico Environmental Department citing 30 alleged violations. These violations resulted from an annual New Mexico Hazardous Waste Management Regulation and Hazardous Waste Act inspection conducted on August 10-18, 1998. The proposed penalties total \$845,990. LANL management has directed the Environmental, Safety and Health division director to coordinate a response within 30 days. (ORPS Report ALO-LA-LANL-LANL-2000-0001)

The December notice stems from a five-month site evaluation conducted during 1997; the 29 violations and associated penalties are a result of this inspection. The violations concern the following.

- Inoperable decontamination equipment (eyewash)
- Failure to provide accumulation start date on container labels
- Failure to keep a container closed
- Illegal storage past 90 days
- Failure to mark the appropriate waste codes on Land Disposal Restriction Notices
- Failure to mark the treatability group on Land Disposal Restriction Notices
- Lack of annual refresher training
- Failure to properly label
- Hazardous waste not under control of the generator
- Failure to determine if the waste was hazardous

The January notice concerns the following violations, some of which were recurring violations not corrected at the time of the inspection.

- Accumulation of hazardous waste over 90 days
- Failure to perform hazardous waste determination
- Failure to perform adequate hazardous waste determination
- Failure to perform weekly inspections
- Failure to mark accumulation date
- Failure to label hazardous waste
- Failure to list hazardous waste code on LDR notice
- Failure to certify LDR certification
- Failure to provide decontamination equipment
- Failure to provide emergency communication equipment
- Failure to provide emergency fire equipment
- Failure to provide timely annual review training
- Failure to maintain adequate operating records
- Failure to keep hazardous waste under control of operator

EH has reported on similar events. Two examples follow.

- On March 21, 1996, the Idaho Department of Health and Welfare, Division of Environmental Quality, sent the DOE Idaho Office a notice of 61 violations of the Hazardous Waste Management Act resulting from inspections at the Idaho National Engineering Laboratory September 12 through 14, 1995, and January 29 through February 2, 1996. The Department of Health proposed penalties for the violations totaling \$317,300.00. The Laboratory remedied four minor violations before the state completed the inspections and no additional actions were required for these. The report stated that the

apparent violations present a moderate or major potential for harm to public health and the environment. (ORPS Reports ID--LITC-LITCOSITEW-1996-0001 and CH-AA-ANLW-ANLW-1996-0002)

- On August 2, 1996, the Ohio Environmental Protection Agency (EPA) sent the DOE Portsmouth Gaseous Diffusion Plant Site Office a notice of violation for Resource Conservation and Recovery Act (RCRA) noncompliances. The agency outlined three areas in the notice: (1) failure to revise the permit, (2) late submission of an incomplete quarterly noncompliance report, and (3) training that was not conducted exactly in accordance with the permit. Because of a subsequent agreement between DOE and the State of Ohio representatives, no fines or penalties were assessed. (ORPS Report ORO--LMES-PORTENVRES-1996-0007)

**KEYWORDS:** environmental inspection, violations, fines

**FUNCTIONAL AREAS:** State Inspection, Operations, Environmental Protection

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